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Inoue et al.

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(54) **GOLF CLUB MANUFACTURING METHOD**

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(30) **Foreign Application Priority Data**

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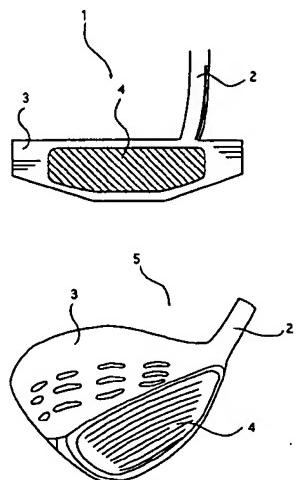
(58) Field of Search 29/527.5; 473/324,
473/349, 345, 350, 342, 329; 164/80, 495

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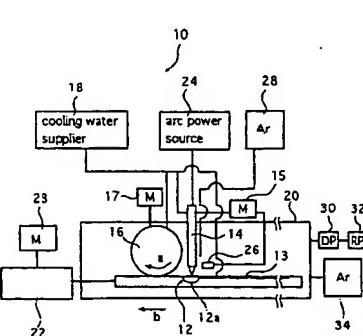
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(57) **ABSTRACT**

A golf club which has a clubface of desired shape comprising an alloy metal is provided. The golf club has excellent strength properties as well as excellent ball hitting properties. The clubface is free from casting defects such as cold shuts, and preferably, free from the crystalline phase formed from crystal nuclei through nonuniform nucleation since the club face is produced in a simple, highly reproducible, one-step process by selectively cooling the molten metal at a temperature above the melting point at a rate higher than the critical cooling rate, and the product comprises a single amorphous phase. The metallic glass face used in the golf club is produced by filling a metal material in a hearth; melting said metal material by using a high-energy heat source which is capable of melting said the metal material; pressing said the molten metal at a temperature above the melting point of said the metal material to deform the molten metal into the desired shape by at least one of compressive stress and shear stress at a temperature above the melting point, while avoiding the surfaces of the molten metal cooled to a temperature below the melting point of said the metal material from meeting with each other during the pressing; and cooling said the molten metal at a cooling rate higher than the critical cooling rate of the metal material simultaneously with or after said the deformation to produce the metallic glass face of desired form.

15 Claims, 10 Drawing Sheets





US006089992A

United States Patent [19]

Onuki et al.

[11] Patent Number: **6,089,992**[45] Date of Patent: **Jul. 18, 2000****[54] GOLF CLUB HEAD**

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[52] U.S. Cl. 473/324; 473/342; 473/349

[58] Field of Search 473/342, 349,
473/409, 324, 345

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McLeland & Naughton

[57] ABSTRACT

In a golf club head having a face body, the face body is composed of a hybrid of an amorphous phase layer and a crystal phase layer. The crystal phase layer is disposed on a reverse face side of a face. And, thickness of the face body is 0.5 mm to 5.0 mm, thickness of the amorphous phase layer is, on average in whole area of the face body, more than 50% of the thickness of the face body, and thickness of the crystal phase layer is arranged to be 0.01 mm to 3.0 mm.

7 Claims, 28 Drawing Sheets

